Simulation of sub-lightline asymmetric Photonic Crystal Mach-Zehnder Interferometer with multimode interference coupler ports

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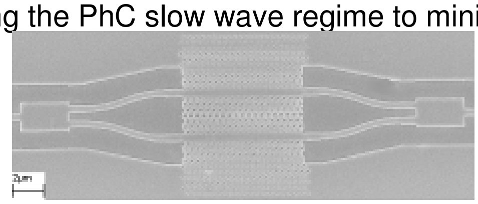
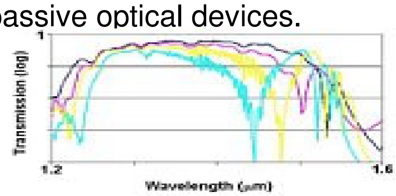
We consider the operation of a symmetric Mach-Zehnder Interferometer (MZI) comprising micron-scale multimode interference couplers (MMIs), with symmetric and asymmetric arms. In each case, the arms consist of W1 triangular-lattice-of-holes photonic crystals (PhCs), designed to operate sub-lightline on an SOI platform – that is, in the so-called "slow wave" regime. The asymmetry is introduced by changing the holes used, which alters the dispersion relation.

Such devices have been modeled with 2 and 3D eigenmode expansion and FDTD methods. The unbalanced MZI gives a notch-filter response, which demonstrates the varying dispersive properties of the different holes. For 20 period PhCs, the notch occurs at sub-lightline wavelengths, which demonstrates the strong possibilities of using the PhC slow wave regime to miniaturize passive optical devices.





Left: SEM image of projected device. Right: Transmission spectra of asymmetric MZIs, showing the variation of the response with device length and wavelength.